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# Life Cycle, Equity Incentives and Innovation

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**Abstract:** Drawing on and combining with relevant theories such as contingency thinking, life cycle and principal-agent, this paper puts forward the assumption that the impact of equity incentive on innovation performance will fluctuate due to the heterogeneity of life cycle. Moreover, a large number of practice results also show that at different stages of development, companies will have different heterogeneous equity incentive methods. This paper takes A-share listed companies from 2007 to 2019 as the research object, analyzes and discusses the following contents by using the empirical research method and Stata17.0 software, and sets the dependent variable and independent variable as innovation performance, and the intensity and mode of equity incentive respectively: (1) The innovation performance of A-share listed enterprises is affected by the equity incentive model; (2) What kind of impact will different life cycle stages have on the relationship between innovation performance and equity incentive of A-share listed companies; (3) What kind of impact will different life cycle stages have on the relationship between equity incentive models and innovation performance of A-share listed enterprises.

**Keywords:** Equity Incentive, Life cycle, Innovation performance, Stock option, Restricted stock.

## 1. Introduction

Innovation is an important engine of economic growth and a key driver of economic growth. Moreover, at present, the two hot topics that most Chinese entrepreneurs and scholars in academia pay attention to are the formation of long-term competitive advantages of companies and how to stimulate and promote business innovation. The Chinese government has clearly pointed out that it is necessary to promote China's economic development and implement "Mass Entrepreneurship and Innovation". The implementation of these policies all reflects that the Chinese government believes that equity incentive is feasible in stimulating corporate innovation. The purpose of this paper is to explore the impact of life cycle heterogeneity on the effect of equity incentives in the existing policy context, and to start the discussion with innovation performance as the measure.

## 2. Literature Review and Hypothesis Development

Stock option by definition refers to the right to get the corresponding number of shares at a certain stage in the future under certain conditions and prices. The beneficiary of the incentive has the right to choose whether to get any shares according to his/her personal will during the exercise period. Restricted stock incentive objects must use their own funds to purchase the granted shares within the specified period, and the exercise conditions are stricter than those of stock options.

Many studies have confirmed that one of the most obvious differences between the two types of equity incentives is the difference in rights and obligations. The incentive object of restricted stock is obliged to purchase the stock with its own capital when the stock is granted. Only when the company meets the agreed vesting conditions and unlocking conditions, the incentive object has the right to sell the granted stock. That is to say, the grantee of restricted stock has sunk costs. When the grantee fails to complete the agreed performance or the stock price falls below the purchase price due to market failure, the grantee will suffer partial losses. Therefore, restricted stock is more binding than stock options[1]. However, stock options are more like an option incentive granted free of charge, and the grantee has no option purchase cost. The minimum expected value of future earnings is 0, that is, when the performance fails to be achieved and the stock cannot be purchased at the agreed price, the grantees can unconditionally give up this right and do not have to bear the loss of stock price decline caused by the chaos of the capital market or the company's poor business performance[10]; There is no upper limit on the maximum expected future earnings, depending on the company's share price and the realization of agreed terms.

Since the incentive and penalty effects of different stock incentive methods are different, the incentive and penalty effects of stock options are asymmetric. Since incentive subjects have the right, but not the obligation, to exercise their incentives, they can avoid the risk of market failure by simply forgoing the exercise of their options. In contrast, restricted stock requires the incentive to buy and hold the stock, and the incentive can only be exercised after the release conditions are met, so the incentive must bear the risk of market failure. Therefore, stock options have a stronger risk-taking effect, which can effectively inhibit the risk aversion of agents and promote innovation and other risky investments [6-7]. Therefore, we hypothesize that:

H1. Stock options and restricted stock have a positive effect on corporate innovation performance, and compared with restricted stock, stock options have a more obvious positive effect on corporate innovation performance.

Firms are in different life cycles with different stage characteristics. In the growth phase, the size, sales volume, financial performance and brand awareness of the enterprise are improved. From the perspective of incentives and human capital, through equity incentives, managers and core employees can enhance the protagonist awareness of the company, and closely integrate it with the development of the company, so as to obtain future benefits related to the long-term performance of the company. Motivated managers will increase investment in innovation and strengthen the monitoring of the innovation process, while motivated employees will actively develop new technologies, processes and products, thus improving the innovation performance of enterprises. In addition, growing companies will also be constrained by funds, and they will not have enough funds for immediate incentives[2]. Therefore, in the growth period of enterprises, the impact of the application of stock options on innovation performance will be more significant.

In the maturity period of the company, the company's scale and profit are the largest, the company's products are gradually mature, the market share and brand awareness are constantly improving, and the profit is gradually stable. In terms of operation, the company's system is very perfect, and the main task of the company at present is to stabilize the market, maintain profitability[9], and prevent or delay the company from stepping into the next life cycle. At this time, the core of equity incentive is to reduce the speculative behavior of managers and make them pay attention to the stability and profitability of enterprises.

When the enterprise enters the recession period, the business situation will undergo tremendous changes. After the expansion and development of the growth period and the prosperity and stability of the maturity period, the scale of the company begins to become redundant, with higher and higher management costs and lower and lower profits. At this time, the loss of talents becomes more and more serious, which leads to the decline of sales revenue, weak scientific research and innovation, and increasing business risks. In this case, if the stable delisting is not considered, then the enterprise should focus on the improvement of products, the development of new technologies, new processes and new products. The strategic goal is to find new growth points in order to achieve the purpose of the company's transformation and sustainable development. Similar to the growth enterprises, the enterprise value in the recession period is relatively low, but if the enterprise successfully transforms, its future stock price will rise significantly[5]. At this time, shareholders who implement stock incentives usually hope that the company can take on new vitality in the reform, so the additional terms of stock incentives can be the company to develop new products. The objectives of the incentives are similar to those of the start-up phase in the growth phase, so there will be a greater focus on innovation. Therefore, we hypothesize that:

H2. The promotion effect of equity incentive on innovation performance in mature enterprises is not as significant as that in growth and decline periods.

According to the view of contingency theory, the governance mechanism of enterprises can only adapt to the environment when it is flexuously adjusted according to the organizational environment and comply with the law of natural selection and survival of the fittest[4]. The above analysis has mentioned the differences in the core agency problem and incentive focus of enterprises in different development stages, as well as the differences in rights and obligations, contract functions and effects of the two incentive methods. Based on this, this paper puts forward the view that there is heterogeneity in the impact of implementing stock options or restricted stock on innovation performance of enterprises in different life cycles. It is believed that enterprises will choose different ways of equity incentive according to their development stages.

First of all, it is well known that the stock price of companies in the growth stage has great potential to rise, and of course there is also the risk of crash. Therefore, the high stock price volatility of companies in the growth stage determines the high intrinsic value of stock options. When there is a strong upward trend in the stock price, the range of returns from stock options is larger than that from restricted stock.

In addition, the implementation of restricted stock through stock repurchase is a great test for the free cash flow of growth stage companies. Due to the limited free cash flow of growth stage companies, they need to focus on solving development problems. Therefore, the incentive method of stock option only requiring a certain option fee is undoubtedly a good medicine for the implementation of incentive for growth stage companies[2].

Finally, the most important purpose of a growth company is to continuously expand the market and develop competitive products to break out of the red sea. To do this, the company needs to provide enough incentive and worry free for the management team to focus on expanding and innovating in the Red Sea. The essence of stock option is an option with additional corporate performance requirements, that is, a right, and the rights and obligations of the option are asymmetric, so the rights and obligations of the stock option are also asymmetric, which can guarantee the elimination of the risk concerns of the incentive object. On the other hand, when the stock price of the company rises, the incentivized object can choose to exercise the option to obtain benefits. The more the stock of the company rises, the income of the incentivized object will also rise accordingly. Therefore, it can encourage them to think about the long-term interests of the company and have the courage to innovate. Therefore, stock options can not only bind the interests of the incentive object with the long-term interests of the enterprise, but also improve the risk-taking level of the incentive object, which is more suitable for the development strategy of enterprises in the growth stage.

There is no significant difference in the impact of the choice of incentive methods on the innovation performance of enterprises in the mature period, and the single stock incentive in this period cannot achieve the incentive effect well. The stock price of the company in the mature stage has little room to rise in the short term. At this time, the company has entered a stable period, the stock price is at a high level, and the upward pressure is great. At this time, the focus of equity incentive is to ensure the development of the company towards the correct strategy, activate the redundant resources, and mobilize the overall operational efficiency[3]. Since the innovation orientation decreases at this stage, there is no significant difference in the impact of single equity incentive on the innovation performance of enterprises in the mature stage. Moreover, the products of enterprises in this stage are mature, the market is stable, the cost and return of innovation investment are not as great as the benefit in the growth stage, and the willingness to innovate is reduced. The innovation of mature enterprises is more affected by the industry and the characteristics of executives, and is not significantly affected by equity incentives.

Companies in recession are more likely to implement stock options. Similar to companies in the growth stage, in the recession stage, the value of a company is relatively low, but it is the so-called survival after death. Therefore, compared with restricted stock, stock options have a greater incentive effect on companies in the recession period.

In addition, corporate profitability in recessions is challenged, with declines in both market share and profitability leading to severe ratings impacts, difficulties and higher financing costs. In order to focus on the pain of transformation and the lack of resources, the low cost of stock options is obviously suitable for enterprises in recession that want to transform.

Finally, rebuilding competitive advantages and completing the transition of life cycle smoothly and quickly are the main incentive goals of declining enterprises, which requires managers to have greater risk-taking ability[8]. The essence of stock option is an option with additional corporate performance requirements, that is, a right, and the rights and obligations of the option are asymmetric, so the rights and obligations of the stock option are also asymmetric, which can guarantee the elimination of the risk concerns of the incentive object. On the other hand, when the stock price of the company rises, the incentivized object can choose to exercise the option to obtain benefits. Therefore, stock options can not only bind the interests of the incentive object with the long-term interests of the enterprise, but also improve the risk-taking level of the incentive object, which is more suitable for the development strategy of high-risk enterprises seeking transformation in the recession period.

At the same time, it should be noted that the goal of implementing equity incentive for enterprises in the elimination period is also different from that of enterprises in the transformation period. Therefore, we hypothesize that:

H3. Specifically, the promotion effect of stock option incentive on innovation performance of companies in the growth stage is better than that of restricted stock; the single incentive method in the mature stage has no significant impact on innovation performance; the implementation of stock option in the transformation stage is similar to that in the growth stage, and has better promotion effect on innovation performance.

# 3. Research Design

## 3.1. Data

This paper uses A-share listed companies from 2007 to 2019 as the original sample, from the CSMAR database, and excludes enterprises with missing data on innovation performance measurement, enterprises with missing data on life cycle measurement, enterprises with financial and insurance industry nature, schemes with compound incentive methods, stock appreciation rights and virtual stocks, and ST companies. In addition, we winsorize the data at the 1% and 99% levels, and obtained 5159 observations. This paper mainly uses the multiple regression analysis method with STATA17.0.

## 3.2. Research Method

To test the relationship between equity incentive and enterprise innovation performance, this paper constructs the following model, where Controls is the control variable:

$$sum\_apply_{i,t}=\beta_1*EI_{i,t}+\Sigma\beta*Controls_{i,t}+\varepsilon_{i,t} \quad (1)$$

To test the relationship between equity incentive mode and enterprise innovation performance, the model is constructed as follows:

$$sum\_apply_{i,t}=\beta_1*SO_{i,t}+\beta*Controls_{i,t}+\varepsilon_{i,t} \quad (2)$$

$$sum\_apply_{i,t}=\beta_1*RS_{i,t}+\beta*Controls_{i,t}+\varepsilon_{i,t} \quad (2)$$

To test the relationship between enterprise life cycle and enterprise innovation performance, according to the groups of life stage, Model (1) is used to conduct three regressions to analyze the difference in the effect of equity incentives in different life cycles.

To test the difference between the two types of equity incentive on innovation performance under the heterogeneity of life cycle, life is further used as the grouping variable, and three groups of life cycle and two types of incentive methods are divided.

**Table 1.** Variable Definition

| Variable | Definition |
|---|---|
| sum_apply | Number of patent applications |
| EI | If the company implements equity incentive, EI takes the value of 1, otherwise it is 0 |
| SO | If the company implements stock option incentive, SO takes the value of 1, otherwise it is 0 |
| RS | If the company implements restricted stock incentive RS takes the value of 1, otherwise it is 0 |
| vos | Annual standard deviation of monthly stock returns of sample firms |
| income | Operating income growth rate |
| ONCF_asset | Ratio of net cash flow from operating activities to total assets |
| lnpay | Natural logarithm of total management compensation |
| Top1 | Shareholding ratio of the largest shareholder |
| mhsr | Shareholding ratio of senior management |
| Dual | If the general manager and the chairman of the board are the same person, the value of Dual is 1; otherwise, it is 0 |
| indboard | Proportion of independent directors |
| lnboard | Natural logarithm of the number of board members |
| lnstuff | Natural logarithm of the number of employees |
| EquityNatureID | If the ultimate controller is a state-owned entity, the value is 1; otherwise, it is 0 |
| lnasset | Natural logarithm of total assets |
| ROA | Return on total assets |
| lev | Total asset-liability ratio |
| lnage | Natural logarithm of the number of years a firm has been established |
| Year | Year dummy variable |
| growth | If the enterprise is in the growth stage, growth is 1; otherwise, it is 0 |
| mature | If the enterprise is in the mature stage, mature takes 1; otherwise, it takes 0 |
| decline | If the enterprise is in the decline stage, decline takes 1; otherwise, it takes 0 |

## 4. Results and Discussion

Through descriptive statistics, correlation analysis, collinearity diagnosis and Hausman test, this paper verifies the feasibility of model design. The regression results of the three hypotheses are shown in the following table:

Panel 1-2 shows the regression results of equity incentive methods on enterprise innovation performance. According to Model (2) and Model (3), the samples are divided into three groups of implementing stock option (SO), restricted stock (RS) and no stock incentive, and the incentive effect of different stock incentive methods is tested. Hypothesis 1 is partially verified: compared with restricted stock, the positive promotion effect of stock option is more obvious.

From Panel 3-5, the regression results of equity incentives and innovation performance under different enterprise life cycles can be obtained. According to the cash flow of operation, financing and investment, the samples are divided into growth period, maturity period and decline period, including 3105 samples in growth period, 1484 samples in maturity period and 570 samples in decline period. The results show that the effect of the implementation of equity incentive in the mature period is not as good as that in the growth and transformation periods.

**Table 2.** Regression Results

| | Panel 1 | Panel 2 | Panel 3 | Panel 4 | Panel 5 |
|---|---|---|---|---|---|
| | sum_apply | sum_apply | sum_apply | sum_apply | sum_apply |
| SO | 47.213** | | | | |
| | (22.071) | | | | |
| RS | | 9.671 | | | |
| | | (8.132) | | | |
| EI | | | 38.190** | 84.858* | 31.092** |
| | | | (19.113) | (50.454) | (12.458) |
| N | 5159.000 | 5159.000 | 3105.000 | 1484.000 | 570.000 |
| R2 | 0.100 | 0.094 | 0.123 | 0.088 | 0.217 |
| adj. R2 | 0.096 | 0.090 | 0.117 | 0.075 | 0.193 |
| Year | Yes | Yes | Yes | Yes | Yes |

From Panel 6-11, it can be seen that for enterprises in the growth stage, the adoption of stock option incentive has an obvious positive promotion effect on innovation performance. Hypothesis 3 is partially verified: there is adaptability between the life cycle and the stock incentive methods.

**Table 3.** Regression Results

| | Panel 6 | Panel 7 | Panel 8 | Panel 9 | Panel 10 | Panel 11 |
|---|---|---|---|---|---|---|
| | sum_apply | sum_apply | sum_apply | sum_apply | sum_apply | sum_apply |
| SO | 61.462* | -8.131 | 34.164*** | | | |
| | (32.095) | (36.179) | (10.393) | | | |
| RS | | | | 7.978 | 20.258 | 60.583*** |
| | | | | (12.681) | (24.848) | (11.799) |
| N | 3105.000 | 1484.000 | 570.000 | 3105.000 | 1484.000 | 570.000 |
| R2 | 0.128 | 0.079 | 0.190 | 0.119 | 0.080 | 0.196 |
| adj. R2 | 0.122 | 0.066 | 0.166 | 0.113 | 0.067 | 0.173 |
| Year | Yes | Yes | Yes | Yes | Yes | Yes |

## 5. Conclusions

This paper selects enterprises from 2007 to 2019 from China's A-share listed companies as research samples. First of all, the concept definition and theoretical analysis are carried out, and on this basis, the research hypothesis is put forward. Then the regression analysis method is used to empirically analyze the relationship between enterprise innovation performance and equity incentive in different life cycle stages, and the research hypothesis is also carried out, and the following conclusions are obtained:

(1) The implementation of stock options in A-share listed companies has A more obvious positive incentive effect on innovation performance compared with restricted stock.

(2) The impact of equity incentive on innovation performance varies with the heterogeneity of the company's life cycle: the promotion effect of equity incentive on innovation performance is more effective in the growth and decline period of the company than in the maturity period of the company.

(3) Due to the different life cycles of companies, their stock incentive models have different impacts on innovation performance; When the company is in the growth stage, the effect of stock option is better than that of restricted stock in terms of incentive effect; However, when the enterprise is in the mature stage, under normal circumstances, only using a single stock incentive method will not achieve good incentive effect; When the enterprise is in the recession period, both restricted stock and stock option can achieve the incentive purpose, mainly because there are two states of elimination and transformation in the enterprise in the recession period.

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